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NOTES ON GEOGRAPHIC DISTRIBUTION

Rediscovery after two decades and geographic range extension of the rare mayfly species, *Behningia baei* McCafferty & Jacobus, 2006 (Ephemeroptera, Behningiidae) from Thailand

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Abstract. *Behningia baei* McCafferty & Jacobus, 2006 was originally described from Phitsanulok Province, Thailand, based on nymphs collected in 2002, but no other information has since been added. Two decades later, in 2024, nymphs of *B. baei* were rediscovered in the Mae Chaem River, Chiang Mai Province. This discovery represents a northern geographic range extension of this species. We provide a photograph of the *B. baei* nymph and a distribution map for this species.

Key words. Distribution map, new distribution, Oriental real, sand burrowing

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INTRODUCTION

Members of the family Behningiidae are seldomly collected and reported. This family comprises only five genera and nine species: four extant genera, namely *Behningia* Lestage, 1930 (five species), *Protobehningia* Tshernova, 1960 (two species), *Dolania* Edmands & Traver, 1959 (one species), and *Paradolania* Zhou, 2024 (one species), and one Jurassic fossil, *Archaeobehningia* Tshernova, 1977 (Hubbard 1994; Zheng et al. 2024). In Thailand, three genera and three species have been reported, including *Protobehningia merga* Peters & Gillies, 1991, *Paradolania nujiangensis* (Zhou & Bisset, 2019), and *Behningia baei* McCafferty & Jacobus, 2006 (Peters and Gillies 1991; McCafferty and Jacobus 2006; Kwanboon et al. 2021). *Behningia baei* was first reported by Parnrong et al. (2002) based on a nymphal specimen of *Behningia* sp. collected in 1998 from Phitsanulok Province. However, *B. baei* was formally described based on late instar nymphal material collected in 2002 from Klong Namklub, Phitsanulok Province (McCafferty and Jacobus 2006). Sangpradub and Boonsoong (2006) used the nymph of *Behningia* sp., collected from the Mae Chaem River (Narumon Sangpradub personal communication), to develop a key for Ephemeroptera. Recently, in 2024, we conducted an extensive survey of mayflies in northern Thailand. This study presents a new distribution for *B. baei*, based on specimens from the Mae Chaem River, Chiang Mai Province, Thailand.

METHODS

Nymphs of the behningiid mayfly were kicked from the fine sandy bottom of the Mae Chaem River, Chiang Mai Province (Figure 1). Specimens were preserved in absolute ethanol. Photographs were captured using a Nikon SMZ800 stereoscopic microscope. The figures were prepared using Adobe Photoshop 2022. The material is deposited in the collection of the Zoological Museum at Kasetsart University in Bangkok, Thailand (ZMKU). The distribution map was constructed using the Simple Mapper website and geographic coordinates from a GPS receiver (Shorthouse 2010).

RESULTS

***Behningia baei* McCafferty & Jacobus, 2006**

Behningia sp.—Parnrong et al. 2002: 407 (new record), Phitsanulok, Thailand.

Behningia baei McCafferty and Jacobus 2006: 47 (original description). Types: late instar nymph, Phitsanulok, Thailand.

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Figure 1. Habitats of *Behningia baei* McCafferty & Jacobus, 2006. **A, B.** The Mae Chaem wadeable river. **C.** Microhabitat (accumulation of fine sandy bottom). **D.** Kick net sampling.

Behningia sp.—Sangpradub and Boonsoong 2006: 114 (nymphal habitus).
Behningia baei—Kwanboon et al. 2021: 67 (habitat).
Figures 2–5

New records. THAILAND – Chiang Mai • Mae Chaem District, Mae Chaem River; 18°29′31″N, 098°21′49″E; 470 m a.s.l.; 15.XII.2024; Sedtawut Kwanboon, Boonsatien Boonsoong, Xuhongyi Zheng leg.; D-frame net kicking methods from fine sandy bottom river; 2 nymphs in ethanol, ZMKU (Ephe-045).

Identification. We follow the original descriptions of *B. baei* by McCafferty and Jacobus (2006). Morphology of mandible (Figure 4A), maxilla (Figure 4B), and gills (Figure 4D) match those of *B. baei* as described by McCafferty and Jacobus (2006). The nymphs of *B. baei* (Figure 3) can be distinguished from other *Behningia* species based on the following combination of characters: i) the trochanter of the middle legs is greatly longer than the coxa (Figure 4C), ii) the labrum is broadly emarginated (Figure 5A, B) and iii) the labial palp

Figure 2. *Behningia baei* McCafferty & Jacobus, 2006. **A.** Fine sand grains from the microhabitat. **B.** Live specimen, dorsal view. **C.** Live specimen, sand burrowing behaviour. **D.** Live specimen, ventral view.

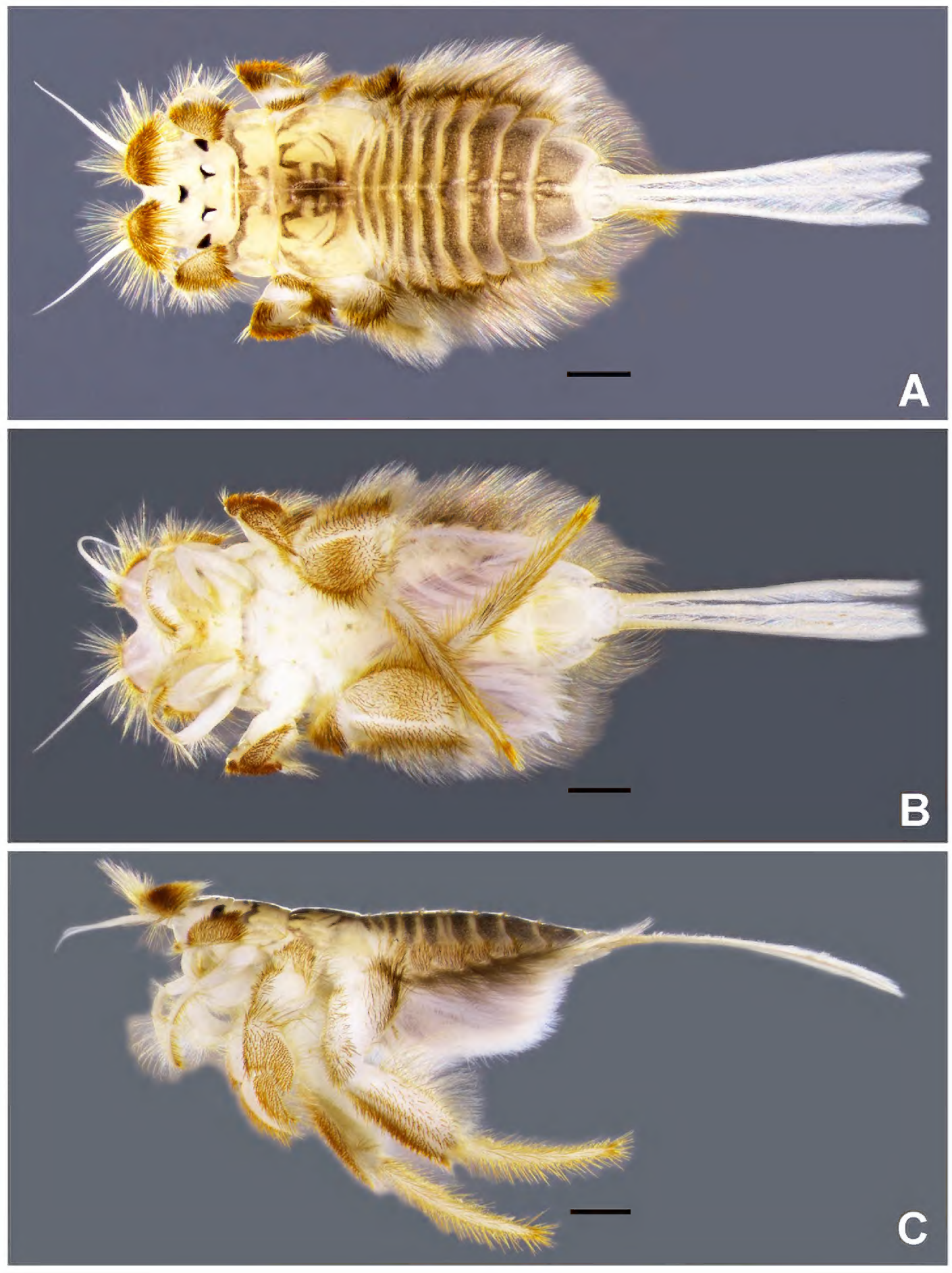

Figure 3. Habitus of nymph of *Behningia baei* McCafferty & Jacobus, 2006. **A.** Dorsal view. **B.** Ventral view. **C.** Lateral view. Scale bars: 1 mm.

segment I is more broadened and lacks concavity along the margin, while palp segment II is relatively short (Figure 5C, D).

Regarding its distribution, *B. baei* is the only species in the genus *Behningia* that occurs in the tropical region. In this study, *B. baei* was distributed in the Phitsanulok and Chiang Mai Provinces.

DISCUSSION

This rediscovery, 22 years after the first description of *B. baei* McCafferty & Jacobus, 2006 in Thailand, demonstrates the broader distribution of this species in this country. The confirmation of *B. baei*, based on nymphal morphological evidence, agrees with the descriptions by McCafferty and Jacobus (2006). In the present study, *B. baei* were found in the Mae Chaem River, Chiang Mai Province, which is 408 km from type locality (Figure 6). The two rivers in which *B. baei* was found in Thailand are characterised by having riverbeds composed of find sandy sediment (Figure 2A). Thus, the habitat of *B. baei* appears to be restricted to fine sandy rivers (Figure 1), similar to that reported for other *Behningia* species, such as *B. tshernovae* Edmunds & Traver, 1959 and *B. sushii* Zheng & Zhou, 2024 (Park et al. 2019; Zheng et al. 2024). We found that the habitat of *B. baei* was similar to the habitat of *Protobehningia merga* in the same river (~3 km downstream) (Kwanboon et al. 2021). These new data about the geographic and habitat distributions of behningiid mayflies helps to fill knowledge gaps and improves our ability to address conservation issues surrounding these rarely seen mayflies, not only in Thailand but also globally.

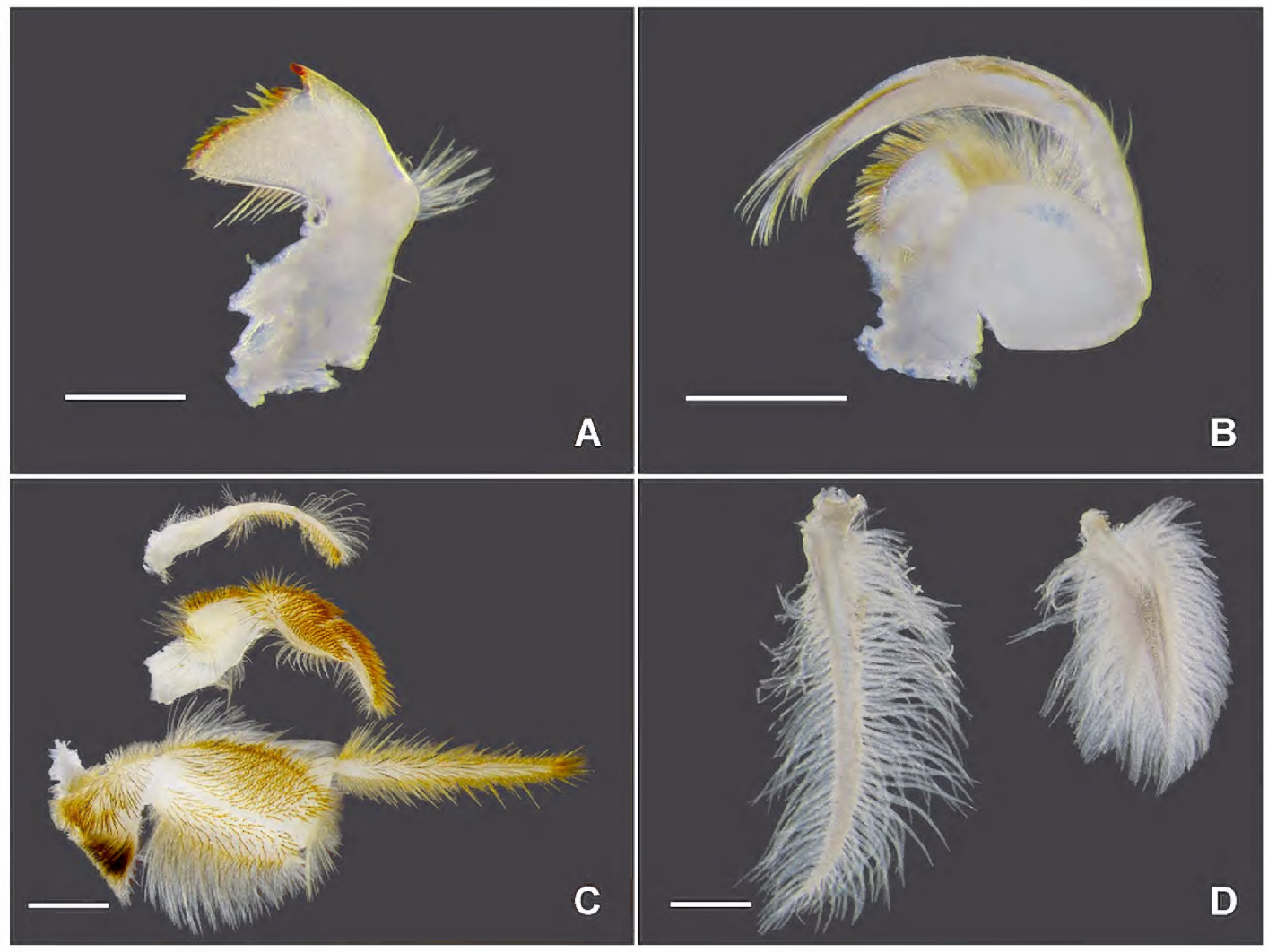

Figure 4. Nymph of *Behningia baei* McCafferty & Jacobus, 2006. **A.** Mandible, left, ventral view. **B.** Maxilla, left, ventral view. **C.** Legs, dorsal view; fore leg, top; middle leg, middle; hind leg, bottom. **D.** Gill I, left; gill II, right. Scale bars: A = 0.25 mm; B, D = 0.5 mm; C = 1 mm.

Figure 5. Nymph of *Behningia baei* McCafferty & Jacobus, 2006. **A.** Labrum, dorsal view. **B.** Labrum, ventral view. **C.** Labium, dorsal view. **D.** Labium, ventral view. Scale bars: 0.5 mm.

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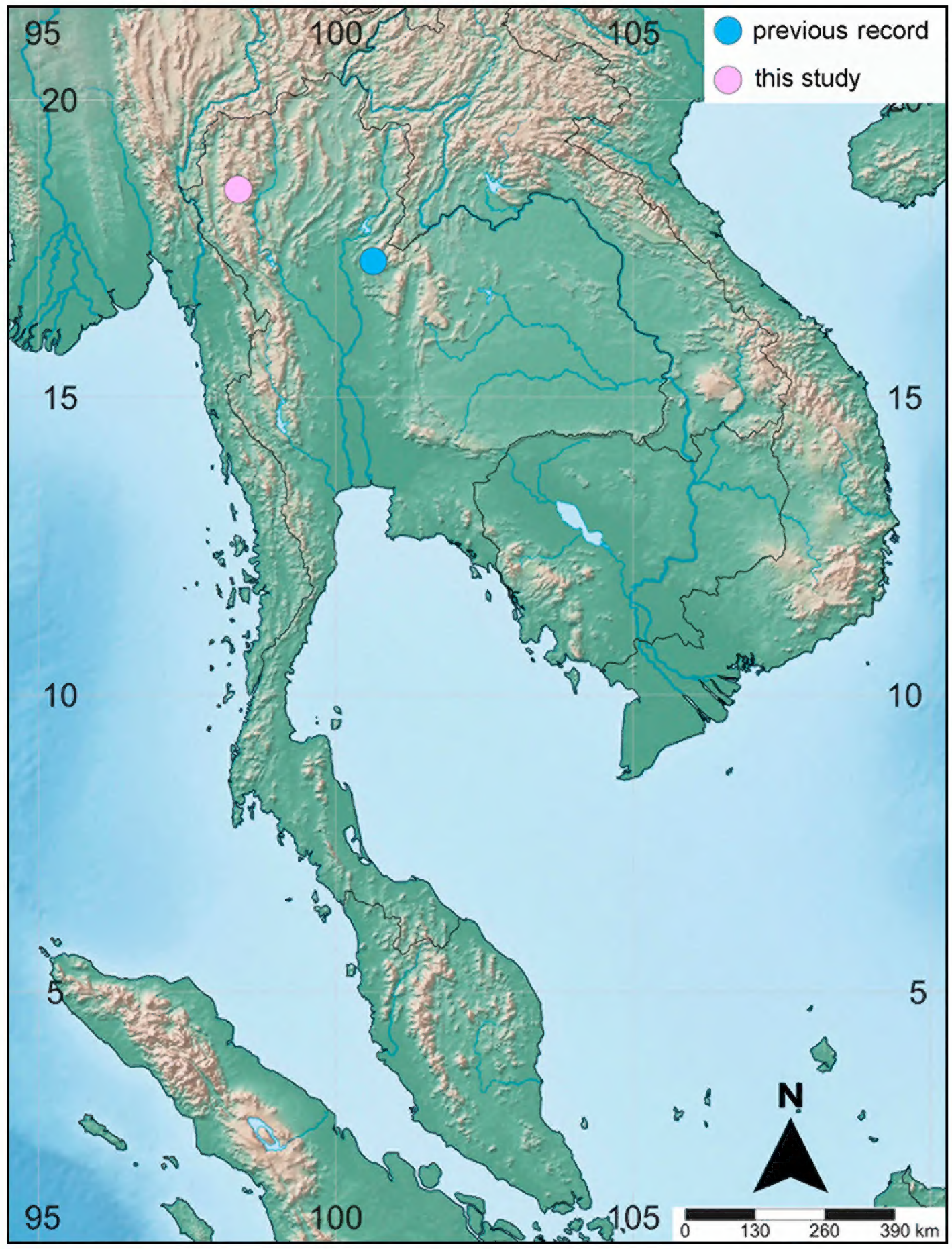

Figure 6. Distribution map of *Behningia baei* McCafferty & Jacobus, 2006 in Thailand.

ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

This research was approved by the Institutional Animal Care and Use Committee, Faculty of Science, Kasetsart University, Thailand under Project number ACKU61-SCI-028.

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Author contributions

Conceptualization: BB, SK. Data curation: SK. Formal analysis: SK, BB. Funding acquisition: BB. Investigation: SK, BB. Methodology: SK, BB. Resources: BB, SK. Supervision: BB. Visualization: SK. Project administration: BB. Software: SK, BB. Validation: BB. Writing – original draft: SK. Writing – review and editing: BB, SK.

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Data availability

All data that support the findings of this study are available in the main text.

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